

Table 2. Systematically selected hiary root articles

Recombinant protein	Protein function	Yield	Rhizosecretion	Culture approach	Transformation method	Plant species	Signal peptide	Reference
<i>Antibody derived</i>								
Chimeric scFvFc 2G8	Antibody fragment against <i>Candida albicans</i>	18.35-23.12 µg/g FW	7 µg/mL (w/ NAA)	Shake Flasks	Direct	<i>N. benthamiana</i>	Embryonic immunoglobulin derived	Catellani et al., 2020
scFv M12	Antibody fragment against human carcinoma vitronectin	70 µg/g FW and 100 µg/g FW (w/KNO3 and NAA)	1.6 µg/mL (w/KNO3 and NAA)	Shake Flask and Bioreactor	Indirect	<i>N. tabacum</i> cv. Petite Havana	/	Häkkinen et al., 2014
2B8-Fc	Antibody fragment against tumour-associated CD20	/	8.35 µg/mL (w/NAA) 16.3 µg/mL (w/2,4-D)	Shake Flasks	Direct	<i>N. benthamiana</i>	Phaseolin	Lonocce et al., 2019
IgG4	Full-length antibody (no informed target)	/	21.8 µg/g DW per day (w/BBI)	Shake Flasks	rol genes transference	<i>N. tabacum</i>	Calreticulin sequence	Komarnitsky et al., 2006
Single chain IgG1	Antibody fragment (no informed target)	/	36.4 µg/g DW per day (w/BBI)	Shake Flasks	rol genes transference	<i>N. tabacum</i>	Calreticulin sequence	Komarnitsky et al., 2006
		/	9.7 µg/g DW per day (w/BBI)	Shake Flasks	rol genes transference	<i>N. tabacum</i>	/	Komarnitsky et al., 2006
H10	Antibody against tumour-associated tenascin C	31.3 µg/g FW	2.24 µg/mL	Shake Flasks	Direct	<i>N. benthamiana</i>	Embryonic immunoglobulin derived	Lonocce et al., 2016
		48.7 µg/g FW	2.70 µg/mL	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Petite Havana	Embryonic immunoglobulin derived	Lonocce et al., 2016
14D9	Antibody that promote transformation of enol ethers	7.80% TSP	/	Shake Flasks	Indirect	<i>N. tabacum</i> var. Ac	KDEL (retention signal)	Marconi et al., 2014
		5.88% TSP	/	Shake Flasks	Indirect	<i>N. tabacum</i> var. Ac	/	Marconi et al., 2014
		13.70 µg/g FW	0.3 µg/mL	Shake Flasks	Indirect	<i>N. tabacum</i> var. Ac	KDEL (retention signal)	Martínez et al., 2005
		41.1 µg/g FW (DMSO)	0.05 µg/mL	Shake Flasks	Indirect	<i>N. tabacum</i> var. Ac	/	Martínez et al., 2005
		4.26 µg/g FW	0.05 µg/mL	Shake Flasks	Indirect	<i>N. tabacum</i> var. Ac	/	Martínez et al., 2005
Guy's 13	Antibody against <i>Streptococcus mutans</i>	950 µg/g DW	2 µg/mL	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	/	Doran, 2006
		730 µg/g DW	/	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	/	Sharp; Doran, 1999
		870 µg/g DW (w/bacitracin)	/	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	/	Sharp; Doran, 2001a
		1,166 µg/g DW	1.82 µg/mL	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	/	Sharp; Doran, 2001b
		1,100 µg/g DW	1.4 µg/mL (w/PVP) 4.0 µg/mL (w/PVP)	Shake Flask and Bioreactor	Indirect	<i>N. tabacum</i> cv. Xanthi	/	Sharp; Doran, 2001b
		1,690 µg/g DW	2.1 µg/mL; 4 µg/mL (KNO ₃) and 10.8 µg/mL (PVP)	Shake Flask and Bioreactor	Indirect	<i>N. tabacum</i> cv. Xanthi	/	Wongsamuth; Doran, 1997
<i>Vaccine</i>								
Coat protein	Viral capsid of <i>Johnson grass chlorotic stripe mosaic virus</i>	7.5-18 µg/g FW	/	/	Direct	<i>N. tabacum</i> cv. Turkish	/	Alemzadeh et al., 2017
Chimeric PD-FcY	Vaccine against <i>bursal disease virus</i>	/	1 µg/mL	Shake Flasks	Direct	<i>N. benthamiana</i>	Embryonic immunoglobulin derived	Rage et al., 2020
Gn and Gc glycoproteins	Vaccine against <i>White Crimean-Congo hemorrhagic fever</i>	1.8 µg/g FW	/	/	Direct	<i>N. tabacum</i>	/	Ghiassi et al., 2011
HBsAg	Vaccine against <i>hepatitis B</i>	0.01-0.06% TSP	/	/	/	<i>N. tabacum</i> cv. Samsun	/	Rukavitsova et al., 2007
F1:V5 Ricin-B linked	Vaccine against <i>Yersinia pestis</i>	250 µg/g TSP	/	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	Potato patatin	Woffenden et al., 2008
Chimeric LSC	Vaccine against enterohemorrhagic <i>E. coli</i> , enterotoxigenic <i>E. coli</i> , and <i>Vibrio cholerae</i>	4.5 µg/g FW	1.1 µg/g FW	Shake Flasks	Direct	<i>N. tabacum</i>	/	Fallah et al., 2018
		5.5 µg/g FW	1.87 µg/g FW	Shake Flasks	Indirect	<i>N. tabacum</i>	/	Fallah et al., 2018
LTB	<i>E. coli</i> B-subunit heat-labile toxin	70-330 µg/g DW	/	Shake Flasks	Direct	<i>N. tabacum</i> cv. Xanthi	/	Guzman et al., 2011
		100 µg/g DW	0.6 µg/mL	Shake Flasks	Direct	<i>N. tabacum</i> var. NC 95	/	Guzman et al., 2012
IpaD	Vaccine against <i>Shigella spp.</i>	500 µg/g TSP	/	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Samson	Zein (Zera®)	Hajibehzad et al., 2017
		420 µg/g TSP	/	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Samson	Extensin	Hajibehzad et al., 2017
<i>Human protein</i>								
Erythropoietin	Hormone	0.066 µg/g TSP	0.185 µg/g FW	Shake Flasks	Direct	<i>N. tabacum</i>	Calreticulin sequence	Gurusamy et al., 2017
hGH	Hormone	~3-6 µg/g FW	/	Shake Flasks	Indirect	<i>N. benthamiana</i>	/	Skarjinskaia et al., 2008
Human Epidermal Growth Factor	Hormone	2 µg/g FW	0.022 µg/mL	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	AP24	Parsons et al., 2010
Chimeric-tPA	Human tissue-type plasminogen activator	850 µg/g TSP	/	Shake Flasks	Direct	<i>N. tabacum</i>	/	Nabiabad et al., 2016
Human hyaluronan synthase 2	Human hyaluronic acid producer	65.72 µg/g FW	/	Shake Flasks	Direct	<i>N. tabacum</i> cv. Turkish	KDEL (retention signal)	Nazeri et al., 2021
Human acetylcholinesterase	Human protein for neurotransmission regulation	3.3% TSP	/	Shake Flasks	Indirect	<i>N. benthamiana</i>	KDEL (retention signal)	Woods et al., 2009
SEAP	Human secreted alkaline phosphatase	~80 µg/g DW	280 µg/g DW	Regenerated Plant	Indirect	<i>N. tabacum</i> cv. Wisconsin	/	Gaume et al., 2003
Single chain interleukin-12	Modified human cytokin	4.9 µg/g FW	0.434 µg/mL	Shake Flask and Bioreactor	Indirect	<i>N. tabacum</i> cv. Xanthi	Native p40 subunit signal peptide	Liu et al., 2008
		33 µg/g FW	/	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	Native p40 subunit signal peptide	Liu et al., 2009
<i>Antimicrobial peptide</i>								
Ranalexin	Antimicrobial peptide derived from American Bullfrog	3.3% TSP	0.28 µg/mL	Shake Flasks	Direct	<i>N. tabacum</i>	Calreticulin sequence	Aleinein et al., 2015
LFchimera	Antimicrobial peptide derived from bovine lactoferrin	3.25-4.8 µg/g FW	/	Shake Flasks	Direct	<i>N. tabacum</i> cv. Xanthi	KDEL (retention signal)	Chahardoli et al., 2018
Cecropini A	Antimicrobial peptide derived from Giant Silk Moth	63.81 µg/g FW	/	/	Direct	<i>N. tabacum</i> cv. Turkish	KDEL (retention signal)	Hashemi et al., 2021
Dermaseptin B1	Antimicrobial peptide derived from South American Hyliid Frog	4.4% TSP	/	Shake Flasks	Indirect	<i>N. tabacum</i> cv. Xanthi	Avr4	Varasteh-Shams et al., 2020
		2.2% TSP	/	Shake Flasks	Direct	<i>N. tabacum</i> cv. Xanthi	Avr4	Varasteh-Shams et al., 2020
<i>Industrial protein</i>								
Miraculin	Sweeter protein for food industry	14,170 µg/g TSP (Promoter CaMV 35s)	/	Shake Flasks	Direct	<i>N. tabacum</i> cv. K326	/	Hong et al., 2021
		19,970 µg/g TSP (Promoter HSP)	/	Shake Flasks	Direct	<i>N. tabacum</i> cv. K326	/	Hong et al., 2021
Thaumatococin I	Sweeter protein for food industry	14,000 µg/g TSP	0.208 µg/mL 2.62 µg/mL (w/NaCl)	Shake Flasks	Direct	<i>N. tabacum</i>	Calreticulin sequence	Pham et al., 2012
		1,800 µg/g TSP	/	Shake Flask	Direct	<i>N. tabacum</i>	/	Pham et al., 2012

FW - Fresh Weight
DW - Dry Weight
TSP - Total Soluble Protein